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Interactions between *Emiliana huxleyi* and the dissolved inorganic carbon system

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Biography of Thomas Henry Huxley (1825-1895)

From Trilling & Bloom (1973)

It may be thought an amusing small curiosity of Victorian intellectual history that when John Henry Newman was a pupil at the private school at Ealing where he had the decisive experience of his life, the self-evidence of God's existence, one of his masters—he is known to have held the young Newman in the highest regard—was the father of T. H. Huxley, among whose claims to fame is the fact that he coined the word "agnostic." It was a word that many Victorians found useful to describe their position as to the existence of God: while disclaiming atheism, it signifies that no predication of either the existence or the non-existence of the Deity can be made on the basis of knowledge.

As Newman dedicated his life to the defense and advancement of religion, especially those of its elements which were transcendent and supernatural, and conceived one of its chief enemies to be the animus and error of the modern scientific imagination, so Huxley was committed to the defense and advancement of science, whose leading antagonist he identified as organized religion. A scientist of great ability, Huxley in time turned from research; although his achievement in that line was considerable, he is now remembered chiefly for his effectiveness as an educator of the public, for having been in his day the pre-eminent exponent of the scientific spirit. As he says in the autobiographical essay he wrote in 1889, he subordinated his ambition for scientific fame to other ends: "to the popularisation of science; to the development and organisation of scientific education; to the endless series of battles over evolution; and to untiring opposition to that ecclesiastical spirit, that clericalism, which in England, as everywhere else, and to whatever denomination it may belong, is the deadly enemy of science."

Thomas Henry Huxley was born at Ealing in 1825. He set store by the first of his Christian names, that of the doubting disciple of Christ, as being indicative of his intellectual temper, although he records of his early childhood a strong identification with the aristocratic vicar of the parish, which led to his preaching to his mother's maids one Sunday morning, his pinafore turned wrong side forward to represent a surplice. His time of systematic education was as short as it was unpleasant. The Ealing school, excellent in Newman's day and for a time thereafter, deteriorated on the death of its headmaster. In 1835, when his son was ten, the elder Huxley gave up teaching and returned to his native Coventry to become manager of a bank. After that, Thomas had no formal instruction. But he read widely in every direction, with a special appetite for science and logical and metaphysical speculation. He held the works of Carlyle in especial admiration and under their influence began to teach himself German. He later went on to the study of French and Italian. In 1841, he undertook the study of medicine, became an assistant to a doctor in one of the poor sections of London, then apprenticed himself to one of his brothers-in-law, attended medical lectures at Sydenham College, and won a Free Scholarship to Charing Cross Hospital. (it is worth relating that the elder Huxley applied to his former pupil, Newman, to support his son's candidacy, and although Huxley's biographer does not say so, we may suppose the request was granted.) In 1845 Huxley took his Bachelor of Medicine degree at the University of London. Through his own enterprise he secured an appointment in the medical service of the navy and was posted to a naval hospital and subsequently to the *Rattlesnake*, a frigate which was being prepared for a long cruise of survey and exploration in Australian and East India waters, to the special end of bringing back an account of the geography, geology, and natural history of New Guinea. For four years the young assistant-surgeon of the ship was unremitting in his researches, carried out with inadequate equipment, chiefly into the physiology of marine animals. (His journal of the cruise was published in 1935.) He sent back numerous scientific articles, some of which were published

before his return in 1850; in 1851, on the strength of his paper on the structure of the Medusae (jellyfish), he was elected Fellow of the Royal Society, a coveted honor, and in the following year was awarded the Society's Royal Medal. Despite this signal recognition, he had difficulty in finding a salaried position, but he continued his research and began to be known as a lecturer and writer whose lucidity and charm of presentation could make any scientific subject comprehensible to virtually anyone. By 1854 his posts were numerous; he was lecturer in Natural History in the Royal School of Mines, Naturalist to the Geological Survey, and lecturer in Comparative Anatomy at St. Thomas's Hospital; the next year he married the young lady to whom he had become engaged on his visit to Australia. His researches at this period dealt with invertebrates, vertebrates, and plants, and during a visit to Switzerland he undertook the study of the action of glaciers. He was instrumental in the establishment of two important scientific journals, the *Natural History Review* and *Nature*.

In 1859 Charles Darwin published his epoch-making *Origin of Species*, which Huxley reviewed for the *London Times*. Evolution was of course not a new idea for the Victorians. In one or another formulation, the theory that the universe had not been brought into being by a special act of creation but that it and its inhabitants, including man himself, had evolved from more primitive forms, had for some time disquieted the religious imagination; the depth of the distress it could cause is classically exemplified by Tennyson's *In Memoriam*, begun in 1833 and published in 1850. But *The Origin of Species* gave a new force to the idea, partly because it specified by its theory of natural selection the means by which biological evolution proceeds, and it was greeted with a vociferous anger which had its roots in the fear that the supernatural basis of religion stood threatened as never before. Huxley, who had rejected the idea of evolution until Darwin's book convinced him of its truth, was drawn into the great national debate that followed—Darwin himself could not be drawn into controversy—and became the pre-eminent polemicist of the evolutionists.

The most famous, and certainly to him most gratifying, moment of Huxley's career as "Darwin's bulldog," came in the exchange between Bishop Wilberforce and him at the meeting of the British Association at Oxford in 1860. The bishop, who had recently attacked Darwin in an elegant but ignorant article, rose to speak in the discussion period and went on for half an hour ridiculing Darwin and Huxley, his line being that there was really no such thing as evolution. "Then, turning to his antagonist with a smiling insolence, he begged to know, was it through his grandfather or grandmother that he claimed his descent from a monkey?" At this, Huxley said to his neighbor, "The Lord hath delivered him into mine hands," rose to answer the bishop, and concluded his statement by saying that "he was not ashamed to have a monkey for his ancestor; but he would be ashamed to be connected with a man who used great gifts to obscure the truth." (There are many different versions of Huxley's precise words, but all agree as to their purport and the effect they produced in the crowded hall, of elation on the part of the pro-Darwinists, of bitterness on the part of the chiefly clerical anti-Darwinists.)

By 1863, although he continued his researches, Huxley's energies, which were inexhaustible despite his frequent ill-health, were increasingly devoted to science as a cultural issue, as the basis of intellectual and even moral virtue. Huxley became, among other things, a leading theorist of education, and one of his later lectures, *Science and Culture* (1880), was the occasion for Matthew Arnold's *Literature and Science* (see above). His insistence that science had to play a larger part in education than it did was based on intellectual rather than utilitarian grounds; the humanistic bent that had led him from Carlyle to Goethe was permanent, and, despite what might be inferred from Arnold's reply, he had no doubt that literature had to be salient in any effectual system of education. This dedicated exponent of the intellectual value of science undertook the study of Greek in his fifties and made it a first requirement in the training of a scientist that he learn to write well.

The honors that came to Huxley in the course of his life were innumerable, and the responsibilities he assumed were equally beyond count. At one time or another he was president of virtually every scientific association of importance; he served on no less than ten Royal Commissions; he was elected to the first London school board. In 1871 he published his *Manual of the Anatomy of Vertebrated Animals*, which remained a standard text at least until the end of the century. His lectures and essays on scientific subjects, which evinced an ever-growing readiness to bring scientific facts and principles to bear upon the problems of ethics and politics, appeared at frequent intervals and were eagerly read. In 1876 he visited America to give an address on university education at the newly founded Johns Hopkins University and stayed on to lecture through the next year. His health had broken down in 1872; it failed again in 1884 and he gave up his salaried posts to retire on a generous government allowance; yet he carried on the activity which he had come to think of as the one to which he had been peculiarly called, that of offering a ceaseless resistance to the ecclesiastical spirit in its continuing, if ever less sanguine, attacks upon science. He died in 1895.

His grandson Aldous Huxley, before undertaking the career as a novelist which brought him fame, intended to be a biologist but was prevented by an eye disease. Sir Julian Huxley, the elder brother of Aldous, is a biologist of great eminence. Andrew Huxley, the half-brother of Aldous and Julian, was awarded the Nobel Prize in 1963 for his work in physiology.

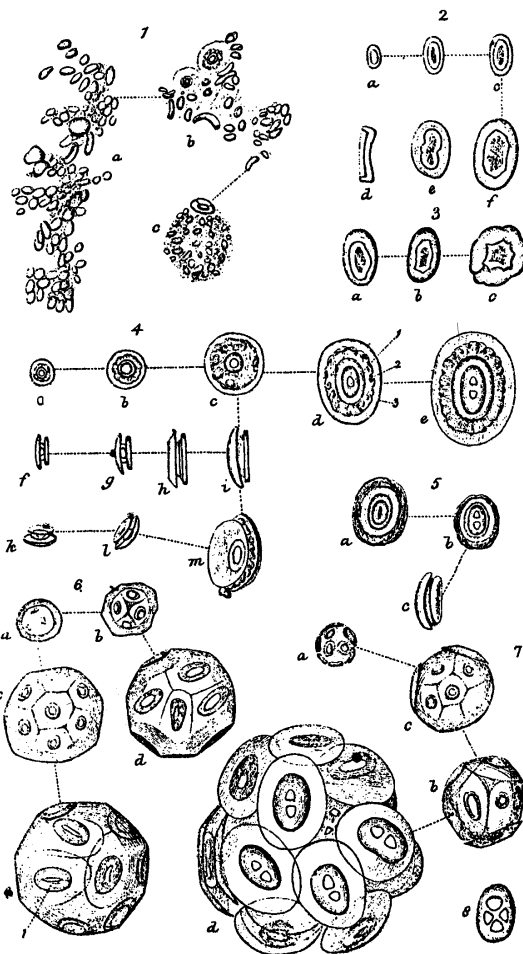


Figure 0.1 Coccospheres and coccoliths from Huxley (1868). Figure 2 in Siesser (1994). (Coccoliths of *Emiliania huxleyi* are too small to observe coccolith morphology with a light microscope.)